

PROCEEDINGS
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NOTES ON TWO PACIFIC COAST AMBYSTOMIDAE

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IN the course of work on the *Plethodontidae* certain facts regarding the *Ambystomidae* have come to light, and they are here offered.

I am able to support Van Denburgh's contention (Proc. Cal. Acad. Sci., (4), VI, p. 221) that *Ambystoma tenebrosum* Bd. and Gir. and *Triton ensatus* Eschscholtz (Zool. Atlas, V, p. 6, pl. 22, 1833) are the same species. A skull of *tenebrosum*, compared with the figure in the Zoologisches Atlas, shows a remarkable similarity even in trivial details. The hyoids also are exactly alike. *Chondrotus* Cope (Amer. Nat., 1887, p. 88) is a synonym of *Dicamptodon* Strauch (Mem. Acad. Sci., St. Petersburg, (7), XV, 4, 1870), as *A. tenebrosum* was the type species of *Chondrotus*.

It would require a great deal more investigation to settle finally the status of the generic relationship of *Ambystoma*, *Dicamptodon*, and *Linguelapsus*. The hyoids of *A. ensatum*, however, differ markedly from those of *A. maculatum*, *A. opacum*, and *A. tigrinum*, all of which are quite alike. The larvae of our eastern species have a fin-fold on the back as far as the head. This is absent in *ensatum* larvae.

Examination of specimens of *Ranodon olympicus* Gaige (Occ. Papers Mus. Zoöl. Univ. Michigan, no. 40, p. 2, 1917), have convinced me that it has very little to do with *Ranodon sibiricus*, and would best stand alone.

RHYACOTRITON gen. nov.

Type: *Ranodon olympicus* Gaige.

Diagnosis. — An Ambystomid salamander with a ring-shaped otoglossal cartilage, no second epibranchial, premaxillas with large nasal processes embracing a fontanelle, no nasals, frontal bordering nares, separate prefrontals and lachrymals, vomerine teeth in two short series; larva with no dorsal fin-fold on body; ypsiloid cartilage aborted; lungs greatly reduced (7 mm. long in a specimen measuring 125 mm.) toes 4 or 5, free. Columella with broad and plate-like expansion, not fused with walls of otic capsule, operculum very small.

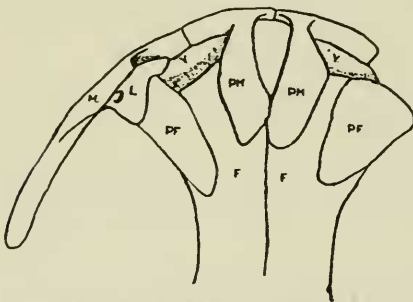


FIGURE 1. Dorsal view of fore part of skull. (Maxilla and lachrymal removed on right side.)

M = Maxilla. PM = Premaxilla. V = Prevomer. L = Lachrymal. PF = Prefrontal. F = Frontal.

of the 'Committee on the Nomenclature of the Cranial Elements in the Permian Tetrapoda.' (Bull. Geol. Soc. Amer., 28, pp. 973-986, 1917.)

All figures are of an adult female of *Rhyacotriton olympicus*, M. C. Z., no. 5880. They are camera drawings enlarged about ten diameters.

Distribution: Olympic Mts., Washington.

Cope proposed to divide the salamanders of this group into two families — one, to include *Ambystoma*, *Linguelapsus* and *Chondrotus* (= *Dicamptodon* Strauch), and the other, *Ranodon*, *Hynobius*, *Salamandrella*, *Batrachuperus* and *Onychodactylus*. The characters were, for the *Ambystomidae*, presence of otoglossal and absence of second epibranchial, and, for the *Hynobi-*

idae, absence of otoglossal and presence of second epibranchial. While I do not see the necessity of dividing this group of salamanders into two families, it is worth noticing that *Rhyacotriton* falls with the genus *Ambystoma* rather than with *Ranodon*.

Another character divides these genera into the same two series. Those of the Asiatic group have very small nasal processes of the premaxillaries which are widely separated on the mid-dorsal line. The American, among them *Rhyacotriton*, have long and broad nasal processes which meet on the median line.

The otoglossal cartilage is ring-shaped, but with a broad dorsal expansion of the ring. This is quite unlike any of Cope's figures of hyoids, yet may be derived without difficulty from that of *A.*

tenebrosus [*ensatum*] or that of *A. jeffersonianum*. The absence of nasals may be due to arrested development, as this bone appears quite late in the larval life of *A. ensatum*.

The otic capsule is nearly closed by a broad expansion of the columella, which is free all round. The projecting end of the columella has a ligamentous attachment with the squamosal. There is another small ossification anterior and ventral to the plate—like part of the columella, and attached to it. This is probably the operculum. From Reed's recent work (Journ. Morph., 33, 2, pp. 325-387, 1920) on the otic bones of *Caudata* it would appear that for some reason the columella has outstripped the operculum. This Reed postulated to have been the case in *Cryptobranchus*. *Rhyacotriton olympicus* spends much of its time in mountain streams, and unquestion-

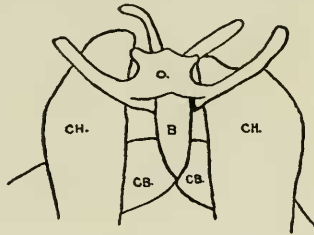


FIGURE 2. Dorsal view of fore part of the hyobranchial apparatus.
O = Otoglossal. B = Basihyal. CH = Ceratotrhylal. CB = First Ceratobranchial.

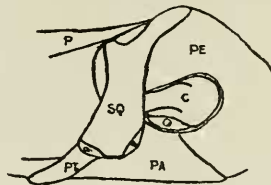


FIGURE 3. Lateral view of the otic region. (Slightly tilted.)
Q = Quadrate. Sq = Squamosal. Pt = Pterygoid. P = Parietal. Pa = Parasphenoid. C = Columella. O = Operculum? Pe = 'Periotic' (= Exoccipital + Paroccipital + Prootic).

ably breeds in them. Therefore the retention of a free columella and the non-development of the operculum is of advantage to the animal. The same thing applies to the entire family *Plethodontidae*, which seems to have had its origin in mountain brooks. Apparently the otic region of the ancestors of the *Plethodontidae* was further advanced at the period at which they entered the brooks than was that of *Rhyacotriton* (which indeed seems a fairly recent immigrant into that habitat), and hence, the operculum has been retained by that family.

It is interesting to find that, in *Rhyacotriton olympicus*, the lungs and the ypsiloid apparatus are greatly reduced. This reduction, which occurs in the whole family *Plethodontidae*, and in six or eight mountain-brook species of *Salamandridae*, is here found in an isolated member of the *Ambystomidae*, which lives in similar situations.

In connection with this genus I have examined the cranial structure of *Ranodon sibiricus*, *Batrachuperus sinensis*, *Onychodactylus japonicus*, *Ambystoma ensatum*, *A. opacum*, *A. tigrinum*, and *A. maculatum*. Wiedersheim's excellent plates of *Ranodon sibiricus* and *Hynobius naevius*, and his descriptions of *H. nebulosus* and *Salamandrella keyserlingii*, (Kopfskelet der Urodelen, 1877), as well as Okajima's figures of *Onychodactylus japonicus* (Zeitschr. f. wiss. Zool., XCI, 3, pp. 351-381, 1908), have been very useful for comparison. In the Asiatic *Ambystomidae* there are two types of vomerine dentition, a continuous or nearly continuous M-shaped series, and a very discontinuous series consisting of two widely separated patches of teeth. The former exhibit a number of transitions between a condition where the prevomers extend back over the parasphenoids and the tooth series extends further back in the middle than on the sides, and one where the prevomers have no such extension and the tooth row is not prolonged in the middle. These extremes are represented by *Pachypalaminus* and *Onychodactylus*, respectively, and the intermediates by *Salamandrella* and the species of *Hynobius*.

The second type has the prevomer not prolonged over the parasphenoids, and is represented by *Ranodon sibiricus* and

Batrachuperus sinensis. *Ambystoma*, in a broad sense, and *Rhyacotriton*, have similar prevomers, and dentition that varies from that of *Rhyacotriton olympicus* and *Ambystoma ensatum*, both of which rather resemble *Ranodon*, to the different condition observed in *Ambystoma tigrinum*. In this species there is a continuous, nearly straight, row of teeth across the roof of the mouth.